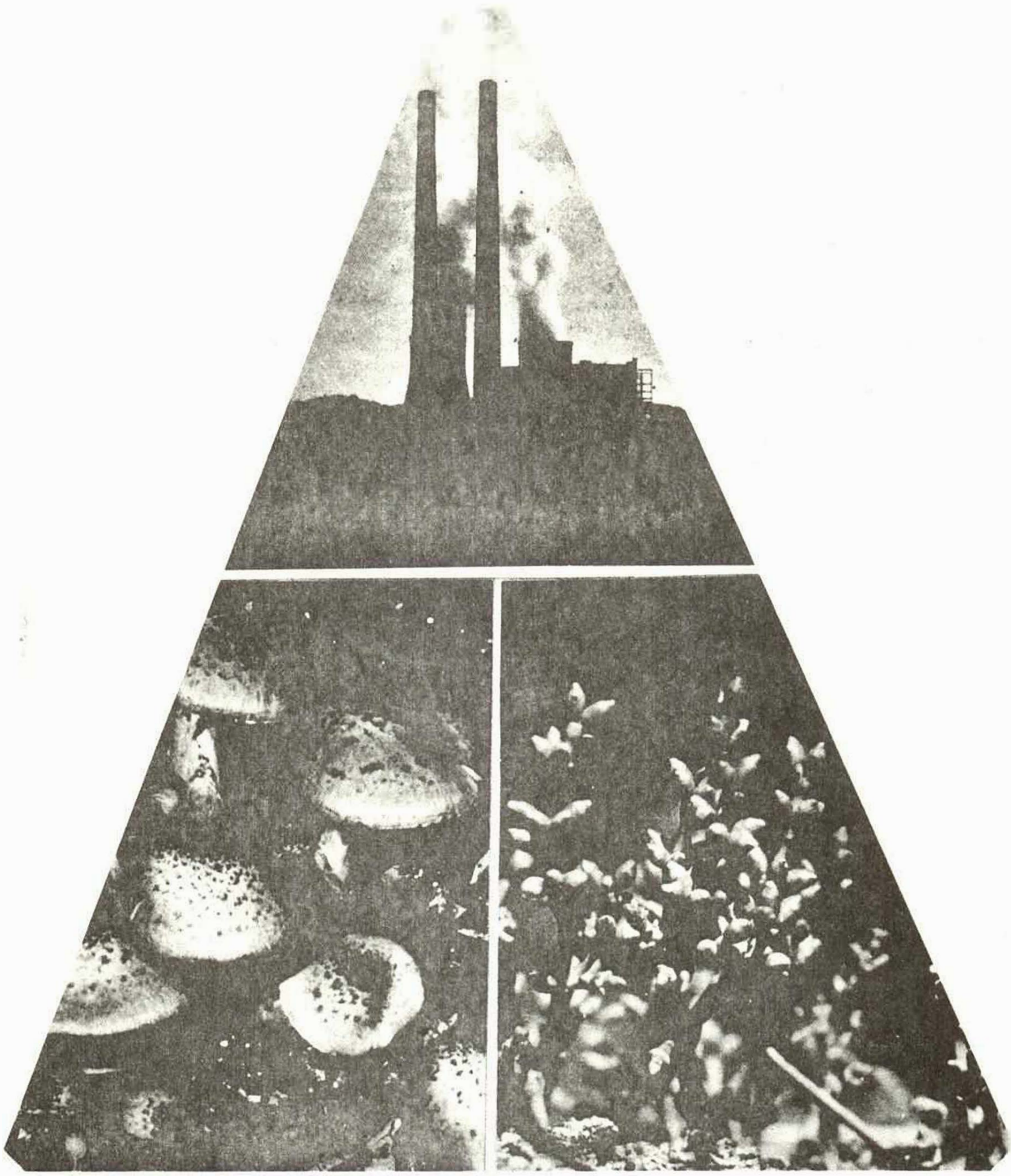
FOREST DISEASE CONDITIONS IN THE NORTHERN REGION 1971



U. S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE
DIVISION OF STATE AND PRIVATE FORESTRY

Report No. 72-2

Missoula, Montana 5280

Cover picture:

The three pictures of the triangle are symbolic of the major groups of forest diseases. The lower pictures show examples of parasitic diseases: (left) mushroom fruiting bodies of the fungus *Armillaria mellea;* and (right) aerial shoots of the seed plant *Arceuthobium laricis*. The upper picture shows a power plant emitting gaseous and particulate pollutants which cause nonparasitic diseases.

Determination of actual yearly impact or even occurrence of various diseases is difficult. Therefore, this report for 1971 is a summary of disease conditions reported by the Forests on pest detection reports, and observed by the pathologists during field evaluations.

DISCUSSION

DWARF MISTLETOE

Dwarf mistletoes (*Arceuthobium* spp.) are the most important disease-causing organisms within the Northern Region (Figure 1). They cause reduction in diameter and height growth and some mortality.

Figure 1.--Brooming of Douglas-fir caused by dwarf mistletoe.

FOREST DISEASE CONDITIONS
NORTHERN REGION
1971

by

Ralph E. Williams, Clinton E. Carlson, and Oscar J. Dooling
Plant Pathologists, Forest Insect and Disease Branch

CONDITIONS IN BRIEF

Dwarf mistletoes are still the most important disease problems within the Region. Diseases at the Coeur d'Alene Nursery are still a problem. Root diseases, although not new to the Region, are a continuing, potentially dangerous hazard to timber production. Stem decays are a significant problem, but will decline as rotation age is reduced. Stem cankers and galls are causing significant growth loss in young stands, and may be more important than formerly thought. Needle cast diseases were widespread and abundant on true firs and two- and three-needle pines. Several needle rusts were abundant on true firs, although actual damage was slight. Air pollution caused by chemicals released into the atmosphere is a serious problem in the Columbia Falls, Montana, area.

INTRODUCTION

Timber losses caused by forest diseases have a significant impact on the level of net growth of timber species. Reduction of such losses consequently represents an important means of increasing timber supplies. In Northern Region forests, diseases cause an estimated annual growth impact of 288 million cubic feet on growing stock, plus an additional impact of 108 million cubic feet on sawtimber. Amount of growth loss is at least double the losses due to mortality.

Because most disease-causing organisms occur at endemic levels in forests of the Northern Region, disease problems are frequently unnoticed until environmental conditions become ideal for disease development and epidemic proportions are reached. Often some mortality results or at least abundant signs and/or symptoms of the disease are evident.

Dwarf mistletoe is destroyed by removal of infected host parts; and can be reduced to tolerable levels by killing infected trees or infected portions of trees. The above practice, where warranted, can be incorporated into normal forest management activities thus obtaining control by silvicultural methods at little extra cost.

Dwarf mistletoe control was proposed on a total of 22,134 acres, but due to monetary restrictions, control work on only 7,058 acres on 11 National Forests was accomplished.

A study was established to measure the growth impact of *Arceuthobium americanum* Nutt. ex Engel. on lodgepole pine *(Pinus contorta* Douglas) on the Gallatin National Forest.

Three crossover infections of the lodgepole pine dwarf mistletoe *(A. americanum)* were found on whitebark pine *(P. albicaulis* Engelmann) on the Gallatin National Forest.

NURSERY DISEASES

As a followup to the 1969 outbreak of *Fusarium oxysporum* Schlecht. and *Verticillium* spp. infection of *Larix occidentalis* Nutt. *Pseudotsuga menziesii* (Mirb.) Franco, and *Picea engelmanni* Parry at the Coeur d'Alene Nursery, 900 of the infected seedlings were outplanted in 1970. Uninfected seedlings from the State Forest Nursery at Missoula were outplanted as checks. Survival was checked during the spring of 1971 and found to vary from 63 to 86 percent. However, many of the surviving seedlings were unhealthy in appearance and likely will die. We estimate that only 50 percent of the seedlings will survive. Because a serious problem exists at the Nursery, we recommend that a thorough evaluation conducted by research and pest control pathologists be made to fully assess the problem and determine biologically feasible control methods.

ROOT DISEASES

In general, root rot organisms require a long period of time to kill a tree. By the time they are noticed, they will have been active for many years.

Accurate diagnosis of root diseases is not easy because symptoms on the aerial portion of the tree are often similar to the symptoms of other diseases. By the time visible symptoms appear, most or all of the root system may be involved or destroyed, with secondary agencies obscuring the primary one (Figure 2).

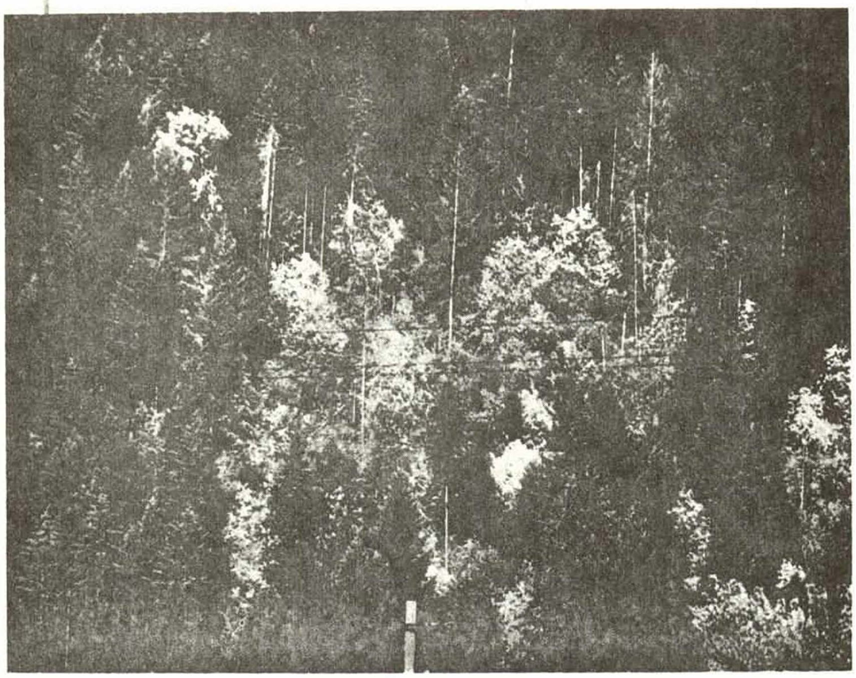


Figure 2.--Mortality in Douglas-fir caused by root rot organisms.

Major root rot areas in Region 1 are found in eastern Washington, northern Idaho, and northwestern Montana. Some minor root rot problems exist on east side Forests.

Armillaria mellea (Vahl ex Fr.) Kummer is endemic to most or all forested areas in the Northern Region. It has been found in nearly all areas and on all species examined. Severity varies from single-tree mortality to selecting out and killing a single species to centers where all species are attacked.

A. mellea usually attacks trees which are growing under stress. This would explain the single tree and/or species selectivity it shows, because it attacks those trees not growing well or unsuited for the area. In the case of root rot centers where all species are attacked, the organism is apparently more virulent so that even "healthy" trees are attacked.

The condition of single-tree or single-species mortality is very evident in *Pinus ponderosa* Laws. plantations on west side Forests. Single species mortality, although less frequent, occurs also in naturally regenerated stands. Examples were evident in several areas on the Lolo National Forest.

Large root rot centers were the least frequently occurring condition; however, nearly every west side Forest had at least one. These large centers ranged from about 1 acre to over 30 acres in size.

Poria weirii Murr. has been found on *Pseudotsuga menziesii, Abies grandis* Lind., *Thuja plicata* D. Don, and *P. ponderosa;* it is most common on the first three hosts. It has been reported to occur on *Tsuga heterophylla* (Raf.) Sarg. and *Pinus monticola* Dougl. It is most frequently found on the Coeur d'Alene National Forest, and is distributed throughout the entire Forest. It occurs to a lesser extent on the Kaniksu and St. Joe National Forests, and is found with increasing frequency near the Coeur d'Alene National Forest.

Preliminary evaluations indicate that on "non-*Thuja*" hosts, *P. weirii* is most abundant on the *P. menziesii*-shrub and *A. grandis-Pachistima myrsinites* (Pursh) Raf. habitat types and occurs in centers of a few trees up to areas 25 to 30 acres in size. *P. weirii* is apparently widespread and coextensive with *T. plicata* throughout its range.

It appears that at least two different types of *P. weirii* occur in this Region. These are the *Thuja plicata* and non-*Thuja plicata* types.

Field identification of *P. weirii* is fairly easy. Its presence on "non-*Thuja*" hosts is enough to consider it as a primary problem.

Fomes annosus (Fr.) Cke. has been found in young *P. ponderosa* plantations on the Colville National Forest, and in mature *Abies lasiocarpa* (Hook.) Nutt. on the Coeur d'Alene National Forest. Identification was made from cultural isolations; sporophores or characteristic decay were not found in 1971. This rotter has not been found with enough frequency to identify it with any habitat type. Examination of additional thinned plantations will probably reveal the presence of more *F. annosus*.

Polyporus schweinitzii Fr. is known to occur in the Region; the velvet-topped sporophores have been found in most areas on the west side, particularly in the *P. menziesii, A. grandis,* and *T. heterophylla* habitat types. It has also been reported from Yellowstone National Park. Decay has been found in abundance in mature *P. monticola* on several areas of the St. Joe National Forest and is also known to occur in *P. menziesii.* It is undoubtedly more common than we originally thought, and its relative importance as a root rotter in the Region has not yet been determined.

Verticicladiella wagenerii Kendrick has been found in *Pinus strobus* L. and P. *contorta* in several *P. strobus* plantations on the Kootenai National Forest. Apparently the disease was introduced on *P. strobus* planting stock, since the rot has been found only in these areas. The possibility exists that *V. wagenerii* is present in other *P. strobus* plantations within the Region.

Polyporus tomentosus Fr. sporophores have been found on the Coeur d'Alene National Forest. Cultures obtained from decay columns on *P. ponderosa* from the Flathead Indian Reservation have been tentatively identified as *P. tomentosus*. The rot is easily confused with that caused by *Fomes pini* (Thore ex Fr.) Karst., and thus may be of more importance than formerly thought.

Poria subacida (Pk.) Sacc. and *Polyporus anceps* Pk. are known to occur in the Region; but their frequency and distribution are not known.

Aerial surveys were made on the Coeur d'Alene National Forest and numerous possible root rot areas were located from the air. Confirmation of several root rot centers was made by ground examination.

Extensive impact surveys will be conducted in the Region beginning in early 1972. Along with root rot information, data concerning insects, other disease problems, habitat type, and other factors of the ecosystem will be collected. This information should aid in formulating management guidelines for particular areas.

Aerial detection methods for root rots and other diseases will be more fully explored in 1972. This will involve the use of both high-level color photography to detect and document root rot areas and low-level infrared (IR) photography to determine extent of root rot infection in individual centers. This will aid the land manager in determining the rate of spread of the rots. If the use of low-level IR photography can be developed and utilized, it could be used in providing guidelines for determining which trees should be cut in salvage logging operations and in commercial and precommercial thinning practices.

STEM DISEASES

Decay

This class of disease causes decay of heartwood and/or sapwood which results in much cull and nonutilization, but seldom is the sole cause of mortality.

Fomes pini is very common throughout the Region, and attacks nearly all coniferous species except *Thuja plicata*. The fungus is most often found in overmature stands; however, some younger *Pinus contorta* Dougl. stands in northern Idaho were found to be badly infected with the decay fungus.

Echinodontium tinctorium (Ell. and Ev.) Ell. and Ev. is a problem in mature and overmature *A. grandis* and *T. heterophylla* stands, and causes a high degree of cull.

Other stem-decaying organisms of continuing importance are *Stereum sanguinolentum* (Alb. & Schw. ex Fr.) Fr., *Polyporus sericeomollis* Rom., *Hydnum abietis* Hubert, and *Fomes officinalis* (Vill.) Faull.

Cankers and Galls

Most obvious symptoms of canker activity are the yellowing and reddening of whole portions distal to the canker on the affected tree. Resulting damage amounts to much branch flagging with some mortality occurring in small diameter growing stock. Under some conditions, "carrot top" disease can cause considerable damage (Figure 3).

Figure 3.--Multiple leaders and spike topping are caused by canker organisms.

Canker diseases of true firs are generally widespread throughout the Region. Canker diseases of pines, except white pine blister rust, are localized in the lower and/or drier ranges of the species involved.

Flagging was conspicuous on true firs in most areas of the Region. Fungi causing the cankers were *Cytospora* spp. and/or *Phomopsis pseudotsuga* M. Wilson. The latter fungus was also found to cause infrequent mortality in seedlings.

Atropellis cankers, which are characterized by a grayish-green to blue-black discoloration of wood beneath each lesion, were generally common throughout pine-producing areas.

Atropellis piniphila (Weir) Lohman and Cash was commonly found causing branch and bole cankers of *P. ponderosa* and *P. contorta* in Montana forests. These cankers frequently girdled the stem resulting in flagging or outright mortality. Mortality was mostly confined to 1-inch diameter growing stock. Other cankers, which had not progressed as far, were severely disfiguring stems and reducing growth.

Atropellis pinicola Zeller and Gooding was found causing cankers on branches of *P. monticola*. Damage was locally heavy in northern Idaho Forests.

White pine blister rust *(Cronartium ribicola* Fisch.*)* continues to be a limiting factor in *P. monticola* management. In some areas, close to 90 percent mortality has been observed.

Damage due to western gall rust, caused by *Peridermium harknessii* J. P. Moore was found to be heavy in several young *P. ponderosa* plantations in northern Idaho. In general, the disease is common wherever its hosts, *P. contorta* and *P. ponderosa,* are found. Mortality does occur in young stems, with major damage to older trees resulting in a pruning effect.

Comandra blister rust *(Cronartium comandrae* Pk.*)* was locally heavy on *P. contorta* throughout its range, but occurred with much less frequency than did *P. harknessii*. This rust was found very infrequently on *P. ponderosa* (Figure 4).

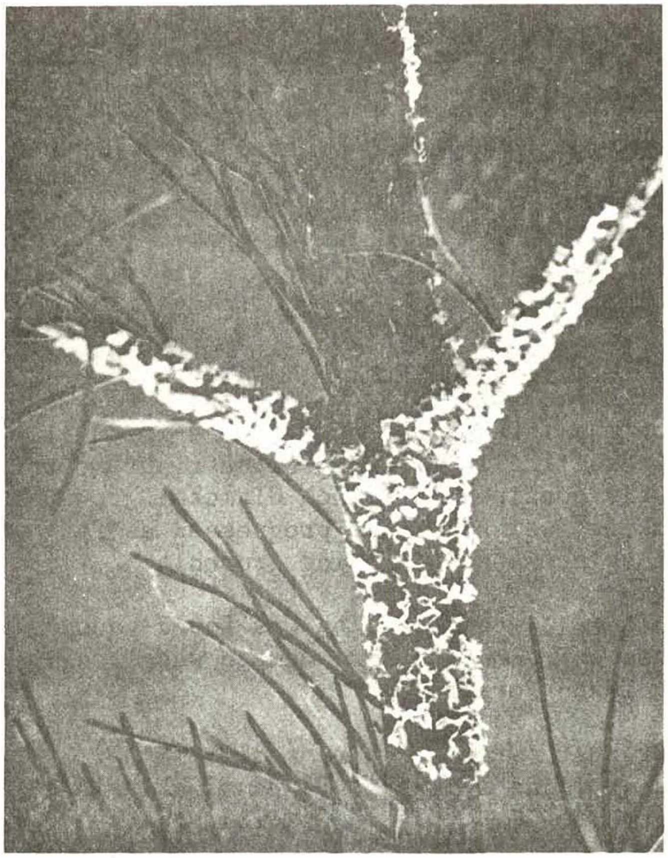


Figure 4.--Comandra blister rust organism fruiting on lodgepole pine.

FOLIAGE DISEASES

Needle Cast

This disease of conifers is widespread in the Northern Region, and is caused by a number of different, but closely related, fungi. It occurs on pines, spruces, firs, larches, and cedar, with its most characteristic symptoms being a red or brown irregular discoloration of certain age classes of foliage. This discoloration may later turn to gray.

Damage caused by needle cast fungi results in a reduction in growth increment brought about by partial but heavy defoliation when the disease becomes epidemic. Needle cast is most serious when young needles on young trees are affected. Defoliation is rarely severe enough to kill any trees except young seedlings. However, young trees may be markedly suppressed by continued attack, resulting in predisposition to attack by other diseases or insects.

Lophodermella concolor (Dearn.) Darker, was locally heavy on *P. contorta* throughout its range on east side Forests. However, it could be found in nearly any area supporting *P. contorta*. In areas of high infection severe defoliation resulted, with no mortality being observed.

Lirula abietis concoloris (Mayr. ex Dearn.) Darker, easily recognized by its brown pycnidia either continuous or interrupted in the groove on the upper surface of 2-year-old needles, was common on *A. lasiocarpa*. Damage was particularly evident on west side Forests.

Although new infections were not observed, Ely needle cast, caused by *Elytroderma deformans* (Weir) Darker, was again prevalent throughout *P. ponderosa* areas. The disease was particularly severe in the Flathead and Bitter Root Valleys (Figure 5).

Lophodermium pinastri (Schrade. ex Hook.) Chev. on *Larix occidentalis* Nutt. was of moderate severity in the Lookout Pass area of the Coeur d'Alene National Forest.

Relatively severe defoliation was observed in several young *P. ponderosa* stands on the St. Joe National Forest. The problem was tentatively attributed to *L. pinastri* since it was the only parasite found on dead and dying needles.

Needle Rusts

Needle rusts are most important on young trees in the seedling and sapling stages. Individual needles, all needles of one growing season, or all needles of an affected branch may die, but these rusts vary in intensity from year to year so that a young tree is never defoliated and killed.

Figure 5.--Elytroderma needle cast brooms on ponderosa pine.

Pucciniastrum goeppertianum (Kuehn) Kleb. was very frequently found on *A. lasiocarpa* on east side Forests. Usually only one or two needles per branch displayed aecia. However, the rust could be found on nearly 80 percent of young *A. lasiocarpa* on some areas.

Melampsorella caryophyllacearum Schroet., causing fir broom rust, was abundant on *A. lasiocarpa* at higher elevations. The rust was found to a lesser extent at lower elevations on *A. grandis* on the Coeur d'Alene National Forest (Figure 6).

Spruce broom rust, caused by *Chrysomyxa arctostaphyli* Diet, was abundant on *Picea engelmanni* on east side Forests. In some cases trees had as many as 6 to 10 large brooms.

Figure 6.--Fir broom rust on subalpine fir.

AIR POLLUTION

Air pollution from chemicals released into the atmosphere is a serious non-parasitic disease. It has been conclusively demonstrated that chemical pollutants cause considerable defoliation and mortality.

The final report of an intensive evaluation of injury to forest vegetation caused by airborne fluorides emitted from the Anaconda Aluminum Company aluminum reduction facility at Columbia Falls, Montana, was completed in November 1971 (Figure 7). Abnormally high levels of fluorides were found in vegetation on more than 200,000 acres of private, State, National Park, and Forest Service lands. Injury to vegetation was found over nearly 69,000 acres. Forest Service data compared very well with data collected by Dr. Clarence Gordon, University of Montana, in the same general area. Also, varying intensities of fluoride accumulation correlated highly with meteorological data collected by the Environmental Protection Agency.

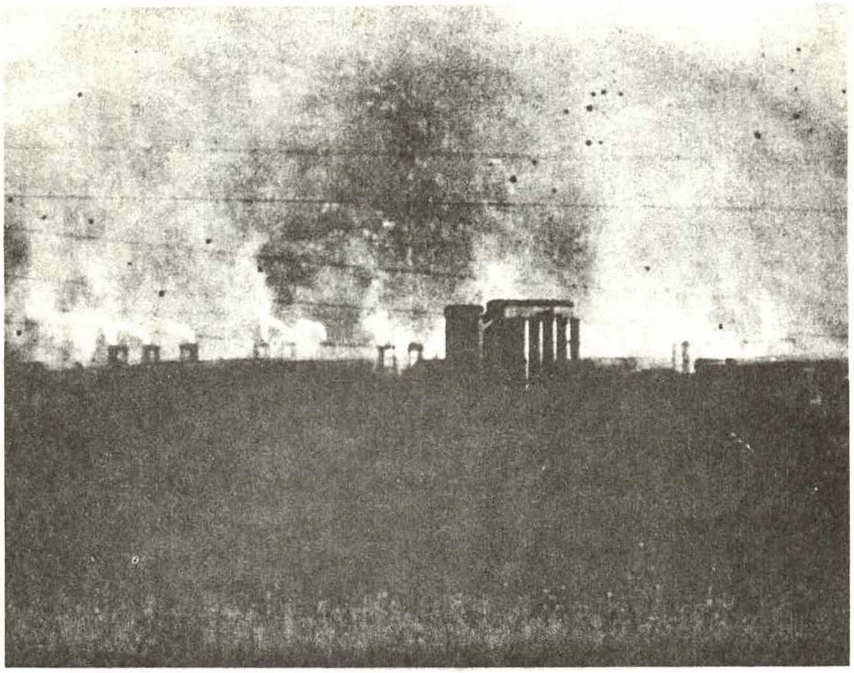


Figure 7.--Fluoride emissions from the Anaconda Company plant at Columbia Falls, Montana, have caused damage to vegetation over a wide area.

No evaluation of impact to wood, water, wildlife, grazing, or recreation was made; however, this easily could be done during the next 2 years.

Fluoride emissions from the Anaconda Company were monitored during 1971 by measuring fluoride levels and resultant injury to vegetation. A 20 percent resampling of plots sampled in 1970 was accomplished. Evaluation of injury is nearly complete, and analysis of tissue concentrations of fluorides has begun. There is considerable injury on current year's needles in about the same area as last year, and the completed fluoride analyses on vegetation indicate that considerable fluorides are still being emitted. The company reported they had reduced their emissions from the 1970 level of 7,600 pounds of fluoride per day to 2,500 pounds per day, but we estimate that a level much below the State standard of 864 pounds per day would have to be attained to effect any significant reduction in accumulation by and injury to vegetation.